

IsoError

Last Revision Date: 11/12/2009

General Information

Model Abbreviated Name: IsoError

Model Extended Name: IsoError

Model Overview/Abstract:

Stable isotope analyses are often used to quantify the contribution of multiple sources to a mixture, such as proportions of pollutant sources to a waste stream, proportions of food sources in an animal's diet, etc. Linear mixing models can be used to partition two sources with a single isotopic signature (e.g., $\delta^{13}\text{C}$) or three sources with a second isotopic signature (e.g., $\delta^{15}\text{N}$). IsoError performs statistical error propagation calculations to determine point estimates and confidence intervals for the source proportion estimates as a function of source and mixture sampling errors and analytical error.

Keywords: Stable isotope analysis, error propagation, uncertainty, estimating source proportions

Model Technical Contact Information:

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Model Homepage: www.epa.gov/wed/pages/models/stableIsotopes/isotopes/isoerror1_04.htm

Substantive Changes from N/A

Prior Version:

Plans for further model None
development:

User Information

Technical Requirements

Computer Hardware

PC

Compatible Operating Systems

Windows 98 or later

Other Software Required to Run the Model

Excel 2000 or later

Download Information

www.epa.gov/wed/pages/models/stableIsotopes/isotopes/isoerror1_04.htm

Using the Model

Basic Model Inputs

Mean isotopic signatures (e.g., atom % or δ), number of samples, and standard deviations for each source and the mixture. (For dietary studies, appropriate isotopic tissue-diet discrimination corrections should be made first.)

Basic Model Outputs

Point estimates and 95% confidence intervals for the proportions of each source's contribution to the mixture

User Support

Other User Documents

Phillips DL and Gregg JW (2001) Uncertainty in source partitioning using stable isotopes. *Oecologia* 127: 171-179.

Phillips DL and Gregg JW (2001) Uncertainty in source partitioning using stable isotopes (Erratum). *Oecologia* 128: 304.

Availability of User Support

e-mail Don Phillips at phillips.donald@epa.gov

User Qualifications

Basic familiarity with stable isotope analysis

Model Science

Problem Identification

Stable isotope analysis is often used to estimate the proportional contributions of sources to a mixture (e.g., nitrate sources to groundwater nitrate) but without any designation of the uncertainty of those estimates. This model uses a statistical error propagation calculation to put error bounds (confidence intervals) around these estimates.

Summary of Model Structure and Methods

The model is an Excel spreadsheet. The user supplies information about the number of samples, and means and standard deviations of isotopic signatures for each source and mixture in highlighted cells on the spreadsheet. The source proportion estimates and 95% confidence intervals are calculated and shown in a box on the spreadsheet.

Model Evaluation

The model and its constituent equations are described in the peer-reviewed journal publication:

Phillips DL and Gregg JW (2001) Uncertainty in source partitioning using stable isotopes. *Oecologia* 127: 171-179.

Phillips DL and Gregg JW (2001) Uncertainty in source partitioning using stable isotopes (Erratum). *Oecologia* 128: 304.

The code was verified by comparison of results to those from an independent program written in SAS for the same purpose. Sensitivity analyses were performed for isotopic differences between sources, source and mixture sample variability, analytical error, and the evenness of source proportions, as described in the above journal paper.

Key Limitations to Model Scope

The model as currently configured is restricted to computing the proportional contributions for two sources using a single isotopic signature, or three sources using two isotopic signatures.

Case Studies

The Phillips & Gregg (2001) paper shown above gives two examples of application (C3 and C4 plant contributions to soil organic carbon, and food sources in the diet of wolves). A wide variety of additional examples can be found in 287 other papers that have cited this paper (per Google Scholar, 11/10/2009).